TM 11-6625-1778-15

331 DEPARTMENT OF THE ARMY TECHNICAL MANUAL

SERVICE, CIRCUIT DIAGRAMS, AND
ILLUSTRATED PARTS BREAKDOWN

RADIO FREQUENCY AMPLIFIER AM-3458/UCM, PART NO. 790-02330-01

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1969

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HEADQUARTERS
DEPARTMENT OF THE ARMY
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NG: None.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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TECHNICAL MANUAL

SERVICE, CIRCUIT DIAGRAMS, AND ILLUSTRATED PARTS BREAKDOWN

RADIO FREQUENCY AMPLIFIER AM-3458/UCM

PART NO. 790-02330-01

(LENKURT)

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Total number of pages in this manual is 20 consisting of the following:

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TABLE OF CONTENTS

INTRODUCTION

This publication is the combined Service, Circuit Diagrams, and Illustrated Parts Breakdown manual for Radio Frequency Amplifier AM-3458/UCM, Lenkurt part number 790-02330-01

For a list of publications governing the use of abbreviations, symbols, terminology, and reference designations used in this manual, refer to T.O. 31W1-2UCC4-2 (TM 11-5805-507-15/1, NAVSHIPS 0967-337-7180).

SECTION I
PRINCIPLES OF OPERATION

1-1. DESCRIPTION.

1-2. The amplifier is a plug-in module of the supergroup carrier supply shelf and the supergroup carrier amplifier shelf, which are major components of Multiplexer Sets AN/FCC-17 and AN/UCC-4(V). It is also used in Telephone Test Sets AN/GCM-2, AN/FCM-8, and AN/UCM-1 (transmission test sets). The function of the module is to

Table 1-1. Amplifier Technical Characteristics

FREQUENCY RANGE	1.0 mc to 3.0 mc
GAIN	33 db
*NORMAL OPERATING LEVEL	
Input	-15.5 dbm
Output	+17.5 dbm
IMPEDANCE	
Input	75 ohms
Output	75 ohms
BREAKPOINT	+18.5 dbm
PHASE SHIFT	180°
EXTERNAL ALARM RELAY	
Coil resistance	8000 ohms
Operate current	2.3 ma or less
POWER REQUIREMENTS	48 vdc at 28 ma
DIMENSIONS (L x W x H)	4-3/16 x 1-15/16 x 4-11/16
WEIGHT	21 ounces

*In the multiplexer set.

amplify any of the eight supergroup carriers in the frequency range between 1 mc and 3 mc. To detect a failure in the amplifier circuit, the module includes a monitor that controls an external alarm relay.

1-3. CIRCUIT OPERATION. (See figure FO-1.)

1-4. The amplifier uses three silicon transistors in cascaded stages: common emitter Q1, emitter follower Q2 (for impedance matching), and common base Q3. Between the first two stages, resistor R10 and capacitor C4 are added to help shape the frequency response. Across transformer T2, capacitor C8 compensates for undesirable phase shift and gain characteristics around the feedback loop through C6 that might produce oscillation at high frequencies.

1-5. BRIDGE FEEDBACK. The feedback loop around the amplifier is connected between balanced resistive bridges. This type of circuit not only reduces distortion and stabilizes gain, but also stabilizes input impedance and output impedance.

1-6. A simplified diagram of the bridge feedback circuit is shown in figure 1-1. The feedback from the output bridge is derived from the sum of the output voltage across R_L and the voltage across R16, the latter being proportional to output current. The output impedance, which is lowered by voltage feedback and raised by current feedback, is stabilized by this combination of both types.

1-7. The amount of feedback, and hence the amplifier gain, is determined by the impedance of R_{IN} relative to R14. Also, to maintain balance in the output bridge, the product of R14 and R16 must equal the product of R_L and R_{EQ}. The output impedance is controlled by the resistance of R15, which does not affect the amount of feedback because the resistor is connected between balanced points on the bridge. Thus, the gain and output impedance of the amplifier are established without interaction.

1-8. The feedback is injected at balanced points on the input bridge and produces two currents. One current through R3 enters transistor Q1 in parallel with the input signal current and lowers the input impedance. The other current through R2 creates a voltage across R1 that is in series with the input signal voltage and raises the input impedance. The combination of shunt current and series voltage stabilizes the impedance and makes it independent of variables in the amplifier itself.

1-9. MONITORS. Two monitor circuits are provided for applications of the amplifier module in the multiplexer set, but they are not used in the transmission test set. One circuit goes through R18 to an external test jack on the multiplexer set where the output signal level can be

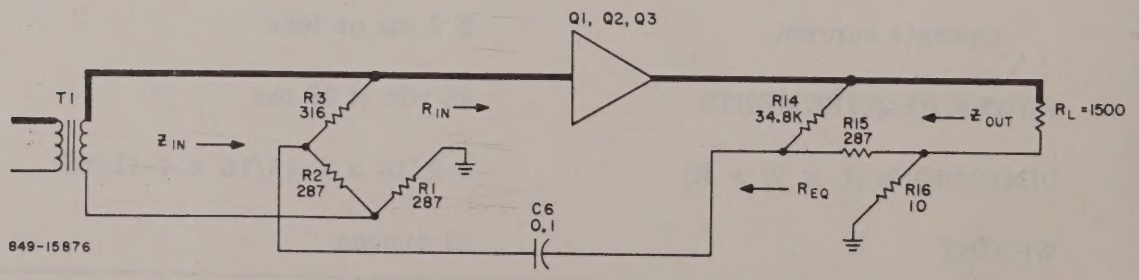


Figure 1-1. Bridge Feedback Circuit

measured on the transmission test set. The other circuit includes transistor switch Q4 controlling an external alarm relay.

1-10. Through R19, a sample of the output signal is rectified by diodes CR1 and CR2 in a voltage doubler arrangement. The dc voltage is applied to the base of Q4, a germanium transistor. At normal signal levels, Q4 turns on and energizes the relay. Loss of signal will turn off Q4 and release the relay.

1-11. Zener diode CR3 and resistor R22 produce the relay operating voltage; in the same circuit, the voltage drop across R21 (about 0.5 volt) is used to reverse bias Q4. Diode CR4 protects the transistor against inductive voltages generated in the relay coil.

SECTION II
MAINTENANCE

2-1. PERFORMANCE TESTS.

2-2. Complete data for testing the amplifier is provided by figure 2-1 and table 2-1.

2-3. ILLUSTRATED PARTS BREAKDOWN.

2-4. Figure 2-2 and the parts breakdown which follows it identify all replaceable parts and subassemblies of the amplifier.

2-5. MFR CODE. This column in the parts breakdown lists the manufacturer's code number (FSCM) according to Cataloging Handbook H4-2, Code to Name. When no number is shown for an item, the manufacturer is Lenkurt Electric Co., Inc., San Carlos, California (FSCM 83744).

2-6. SOURCE CODE AND REPAIR CODE. For definitions of codes in these columns of the parts breakdown refer to introduction to illustrated parts breakdown in T.O. 31W1-2UCC4-4 (TM 11-5805-507-15/3, NAVSHIPS 0967-337-7200).

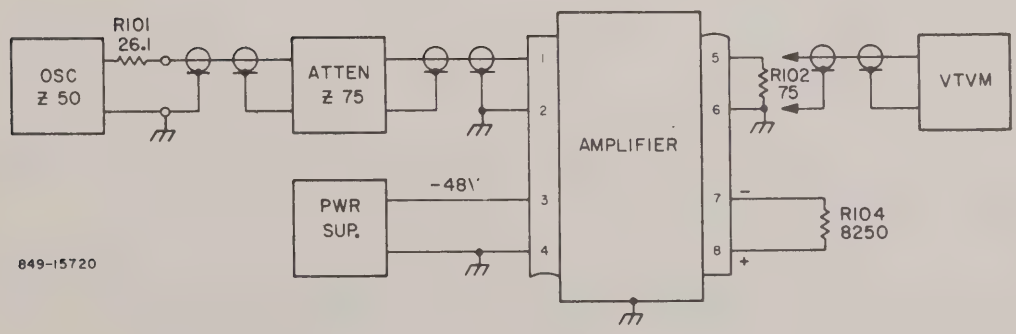


Figure 2-1. Amplifier Test Circuit Diagram

Table 2-1. Amplifier Performance Tests

STANDARD TEST EQUIPMENT REQUIRED

a. High Frequency Signal Generator, Hewlett-Packard model 606A (oscillator)

b. Level Meter, Siemens & Halske type Rel-3-D-335d3a

c. Oscilloscope, Tektronix type 310A

d. Power Supply, Hewlett-Packard model 711A (48 vdc at 35 ma)

e. Variable Attenuator, Siemens & Halske type Rel-3-D-117b

f. Volt-Ohm-Milliammeter, Triplett model 630-NA (multimeter)

SPECIAL TEST EQUIPMENT REQUIRED

None

MATERIAL REQUIRED

a. Socket, electron tube; 9-contact, MIL-S-12883 type

b. Resistor, fixed, film; ±1% tolerance, 1/2 watt, MIL-R-10509 type

26.1 ohms (R101)

75 ohms (R102, R103)

8250 ohms (R104)

PRELIMINARY INSTRUCTIONS

a. Set up test circuits shown in figure 2-1. Connections to module are to be made through electron tube socket.

b. To reduce noise and prevent ground loops, adapter plugs may have to be inserted in test equipment power cords to isolate test circuits from ac ground.

c. Test bench should be equipped with a separate low impedance connection to earth ground. Keep ground leads in test circuit as short as possible.

d. Pin numbers specified in procedure refer to module or mating socket.

e. Set level meter controls for 75-ohm bridging measurement in wideband (2-kc bandwidth) mode. In the test procedures, tune level meter to specified oscillator frequency.

Table 2-1. Amplifier Performance Tests (Cont)

f. Resistor R101 produces an equivalent oscillator source impedance of 75 ohms. In the test procedures, R101 shall be considered as part of the oscillator.

g. With module removed from test circuit, measure resistance between the following points on module:

Pins 5 and 9: 1330 ohms

h. Turn power supply voltage adjust to zero.

i. Plug module into test circuit.

j. Adjust power supply voltage to 48.0 volts and measure dc input current to module at pin 3. Normal current is about 28 ma.

k. Each test is independent and may be performed without regard to preceding or following tests. For complete checkout of module, perform tests in sequence.

WARNING

Turn off power supply when changing connections on the test circuit.

STEP	PROCEDURE	NORMAL INDICATION
	Test No. 1. Gain	
	NOTE Module must be assembled in its can for this test.	
1A	Set attenuator at 33 db.	
1B	Connect level meter to oscillator.	
1C	Set oscillator at 3.0 mc and adjust its output level for reading of -3.0 dbm on level meter.	
1D	Transfer level meter to pins 5 and 6. Note and record level.	-3.0 dbm ±1.2 db

Table 2-1. Amplifier Performance Tests (Cont)

STEP	PROCEDURE	NORMAL INDICATION
1E	Repeat procedure of steps 1B through 1D at each of the frequencies listed in the adjacent column, in turn.	With respect to level recorded in step 1D at 3.0 mc: 0.5 mc: +0.2 to -2.8 db 1.0 mc: +0.4 to -1.0 db 7.0 mc: +2.0 to -0.5 db 9.0 mc: +3.0 to -1.0 db 11.0 mc: +3.0 to -4.0 db
	Test No. 2. Input Impedance	
2A	Connect level meter to oscillator.	
2B	Set attenuator at 33 db.	
2C	Set oscillator at 3.0 mc and adjust its output level for reading of -23.0 dbm on level meter.	
2D	Set attenuator at 0 db and read level meter.	-23.0 dbm ±0.3 db
2E	Repeat procedure of steps 2B through 2D at 1.0 mc.	-23.0 dbm ±0.3 db
	Test No. 3. Output Impedance	
3A	Set attenuator at 0 db.	
3B	Connect level meter to pins 5 and 6.	
3C	Set oscillator at 3.0 mc and adjust its output level for reading of +3.0 dbm on level meter.	
3D	Connect 75-ohm resistor R103 to pins 5 and 6, producing a double termination on amplifier output. Read level meter.	-0.5 dbm ±0.4 db
3E	Disconnect R103.	
3F	Repeat procedure of steps 3C through 3E at 1.0 mc.	-0.5 dbm ±0.4 db

Table 2-1. Amplifier Performance Tests (Cont)

STEP	PROCEDURE	NORMAL INDICATION
	Test No. 4. Breakpoint	
4A	Set attenuator at 0 db.	
4B	Connect scope and level meter to pins 5 and 6.	
4C	Set oscillator at 3.0 mc and adjust its output level until sine wave displayed on scope just begins to clip. Read level meter.	+17.2 dbm minimum
4D	Repeat step 4C at 1.0 mc.	+17.2 dbm minimum
	Test No. 5. Monitor Circuit	
5A	Set attenuator at 0 db.	
5B	Connect level meter to pins 5 and 6.	
5C	Connect multimeter (dc volts) to pins 7 (negative) and 8.	
5D	Set oscillator at 1.0 mc and adjust its output level for reading of 13.0 volts on multimeter. Read level meter.	+5.2 dbm to +10.2 dbm
5E	Adjust oscillator output level for reading of 23.0 volts on multimeter. Read level meter.	+6.7 dbm to +11.9 dbm
	Test No. 6. Phase Shift	
6A	Set attenuator at 33 db.	
6B	Connect level meter to pins 5 and 6.	
6C	Set oscillator at 1.0 mc and adjust its output level for reading of +15 dbm on level meter.	
6D	Connect pins 5 and 6 to horizontal input of scope.	
6E	Adjust scope to display horizontal line of about two scale divisions.	

Table 2-1. Amplifier Performance Tests (Cont)

STEP	PROCEDURE	NORMAL INDICATION
6F	Transfer connection on scope to vertical input.	
6H	Adjust scope to display vertical line of about two scale divisions.	
6I	Connect pins 5 and 6 to both inputs of scope, which should then display a line tilted at 45°	
6J	Transfer vertical input of scope to oscillator and note orientation of line displayed on scope.	Line shall be tilted at right angles to line in preceding step, indicating 180 phase shift. There may be an opening in the line.

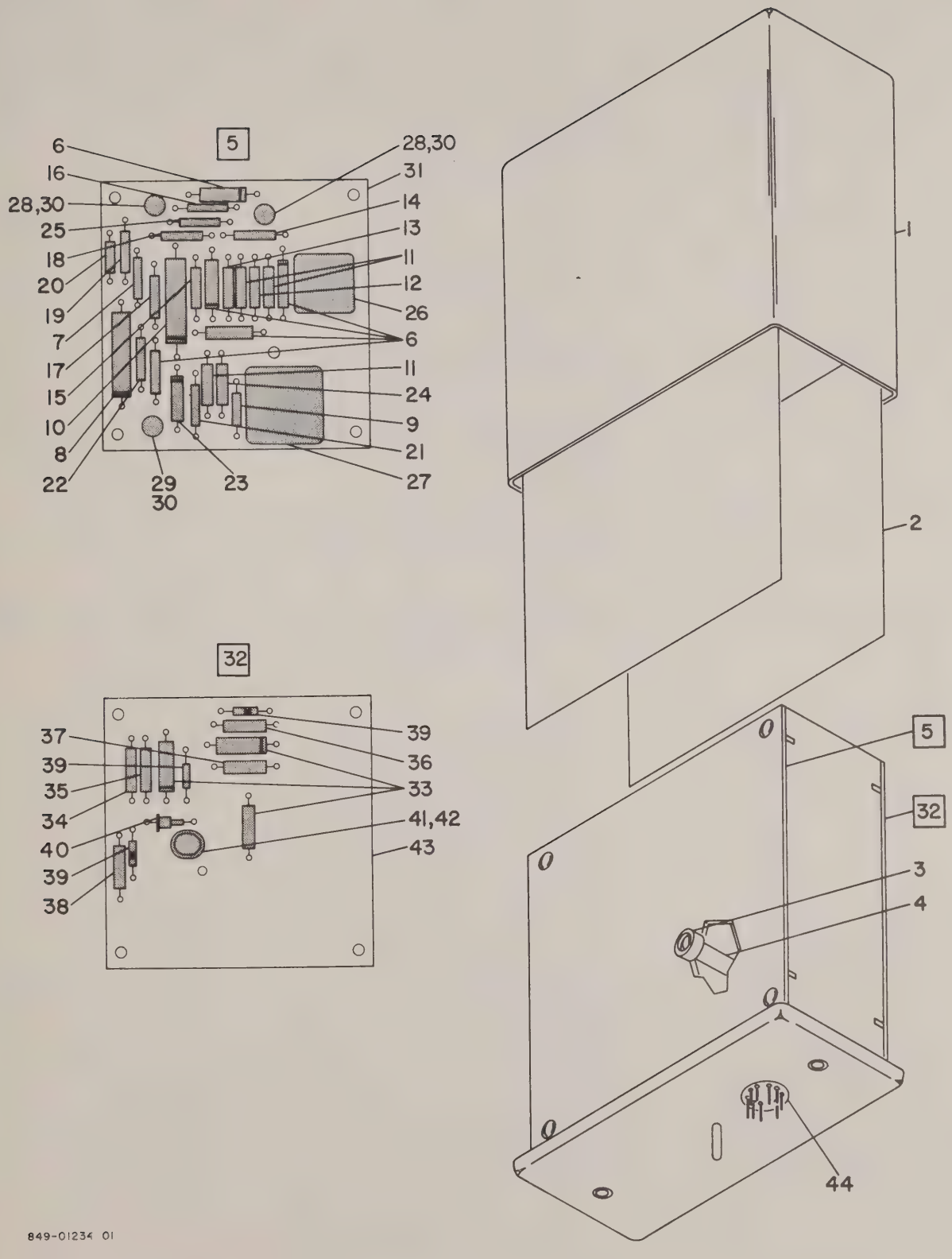
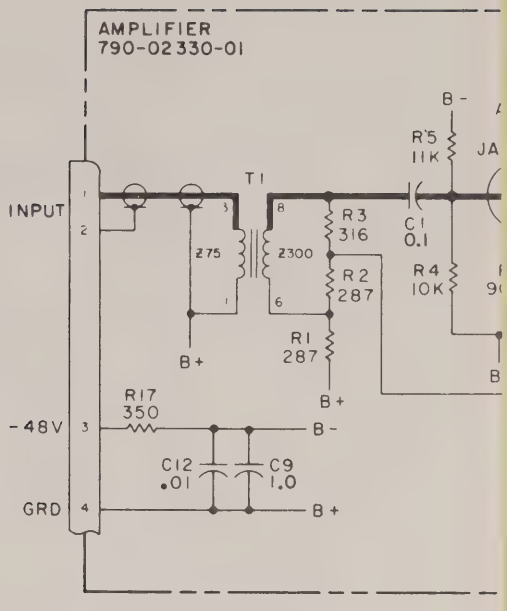


Figure 2-2. RF Amplifier AM-3458/UCM

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7 8 9	MFR CODE	UNITS PER ASSY	SOURCE CODE	REPAIR CODE
2-2-	790-02330-01	AMPLIFIER, RF, AM-3458/UCM . .		1	P1	L
-1	720-03247-01	. CAN, MECHANICAL SEALING . . .		1	X2	
-2	720-02579-13	. INSULATOR, PLATE		1	X2	
-3	720-01721-02	. SPACER, STEPPED		2	X2	S
		ATTACHING PARTS				
	MS35233-14	. SCREW	96906	2	P1	
		- - - * - - -				
-4	720-02301-16	. SPACER, NM, 4-40 thd both . . . . ends, 1/4 in. dia, 1-7/16 in. lg		1		
-5	790-06945-01	. RF AMPLIFIER SUBASSEMBLY . .		1	P1D	L
		ATTACHING PARTS				
	231-090751-00-0101	. RIVET, BLIND, Round hd, plstc, . per 83744 spec dwg 733-00517-01	02768	4	X2	
		- - - * - - -				
-6	760-20310-03	. . CAPACITOR, FXD, PLSTC, . . 0.1 μf, 10%, 150 v (C1, C2, C3, C6, C7)		5	P1	S
-7	CM15E111J	. . CAPACITOR, FXD, MICA, . . . 110 $\mu\mu$f, 5%, 300 v, per 83744 spec dwg 760-16211-00 (C4)	84171	1	P1	S
-8	760-20368-03	. . CAPACITOR, FXD, PLSTC, . . 0.68 μf, 10%, 150 v (C5)		1	P1	S
-9	CM15E050J	. . CAPACITOR, FXD, MICA, . . . 5 $\mu\mu$f, 5%, 300 v, per 83744 spec dwg 760-16200-50 (C8)	84171	1	P1	S
-10	760-20310-04	. . CAPACITOR, FXD, PLSTC, . . 1.0 μf, 10%, 150 v (C9)		1	P1	S
-11	RN65D2870F	. . RESISTOR (R1, R2, R15)	81349	3	P1	S
-12	RN65D3160F	. . RESISTOR (R3)	81349	1	P1	S
-13	RN65D1002F	. . RESISTOR (R4)	81349	1	P1	S
-14	RN65D1102F	. . RESISTOR (R5)	81349	1	P1	S
-15	RN65D9091F	. . RESISTOR (R6)	81349	1	P1	S
-16	RN65D5111F	. . RESISTOR (R7)	81349	1	P1	S
-17	RN65D1212F	. . RESISTOR (R8)	81349	1	P1	S
-18	RN65D1471F	. . RESISTOR (R9)	81349	1	P1	S
-19	RN65D82R5F	. . RESISTOR (R10)	81349	1	P1	S
-20	RS1A1201F	. . RESISTOR, FXD, WW, 1200 . . ohms, 1%, 1 w, per 83744 spec dwg 770-00009-13 (R11)	91637	1	P1	S
-21	RN65D5621F	. . RESISTOR (R12)	81349	1	P1	S
-22	RN65D8251F	. . RESISTOR (R13)	81349	1	P1	S

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7 8 9	MFR CODE	UNITS PER ASSY	SOURCE CODE	REPAIR CODE
2-2-23	RN65D3482F	. . RESISTOR (R14)	81349	1	P1	S
-24	RN65D10R0F	. . RESISTOR (R16)	81349	1		
-25	RS1A3500F	. . RESISTOR, FXD, WW, 350 . . . . ohms, 1%, 1 w, per 83744 spec dwg 770-00009-14 (R17)	91637	1	P1	S
-26	791-08216-01	. . TRANSFORMER, RF (T1)		1	P1	S
-27	791-08257-01	. . TRANSFORMER, RF (T2)		1	P1	S
-28	JAN2N3251A	. . TRANSISTOR (Q1, Q2)	81350	2		
-29	JEDEC2N699	. . TRANSISTOR (Q3)	07688	1	P1	S
-30	1932XM	. . PAD, MTG, TRANSISTOR, ... per 83744 spec dwg 735-00239-01	13773	3	X2	
-31	790-03249-01	. . PRINTED CIRCUIT BOARD		1	X1	
-32	790-11076-01	. RF AMPLIFIER SUBASSEMBLY . .		1	P1	P
		ATTACHING PARTS				
	231-090751-00-0101	. RIVET, BLIND, Round hd, plstc, . . per 83744 spec dwg 733-00517-01	02768	4	X2	
		- - - * - - -				
-33	760-21310-02	. . CAPACITOR, FXD, PLSTC, . . . 0.01 μf, 10%, 150 v (C10-C12)		3	P1	S
-34	RN65D1331F	. . RESISTOR (R18)	81349	1	P1	S
-35	RN65D6190F	. . RESISTOR (R19)	81349	1	P1	S
-36	RN65D5111F	. . RESISTOR (R20)	81349	1	P1	S
-37	RN65D1000F	. . RESISTOR (R21)	81349	1	P1	S
-38	RN65D3161F	. . RESISTOR (R22)	81349	1	P1	S
-39	JAN1N126A	. . SEMICONDUCTOR DEVICE, . . . DIO (CR1, CR2, CR4)	81350	3	P1	S
-40	JAN1N3030B	. . SEMICONDUCTOR DEVICE, . . . DIO (CR3)	81350	1	P1	S
-41	JAN2N167A	. . TRANSISTOR (Q4)	81350	1	P1	S
-42	1932XM	. . PAD, MTG, TRANSISTOR, per . 83744 spec dwg 735-00239-01	13773	1	X2	
-43	790-11077-01	. . PRINTED CIRCUIT BOARD		1	X1	
	790-03248-02	. COVER, HEADER AND BRACKET . ASSEMBLY		1		
-44	VC2007	. . TERMINAL, HEADER, 9-pin, . . per 83744 spec dwg 755-00130-02	16488	1	X2	



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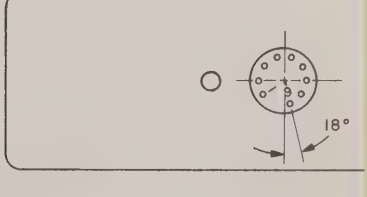
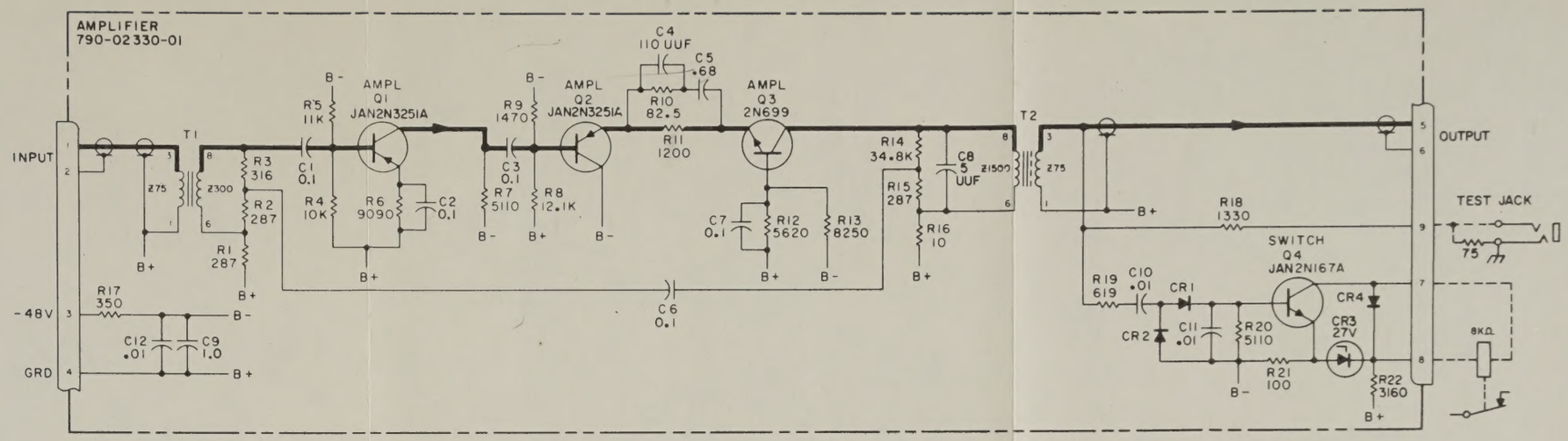
NOTES:

1. COMPONENT VALUES ARE IN OHMS AND MI
UNLESS OTHERWISE NOTED.
2. DC RESISTANCE OF TRANSFORMER WINDING
THAN ONE OHM IS NOT SHOWN.
3. EXTERNAL CIRCUITS TO WHICH MODULE IS
IN NORMAL OPERATION ARE SHOWN BY DAS
4. DC VOLTAGES AT TRANSISTOR TERMINALS
TO PIN 4 WITH A VTVM HAVING AN INPUT R
11 MEGOHMS. INPUT SIGNAL WAS 1.0 MC
VOLTAGES ARE NEGATIVE WITH RESPECT T

	E	B	C
Q1	17.2	17.6	29.
Q2	33.8	34.1	38.
Q3	16.5	15.9	0.
Q4	38.0	37.7	37.

5. HEADER POSITION DIAGRAM.





849-15786

NOTES:

1. COMPONENT VALUES ARE IN OHMS AND MICROFARADS UNLESS OTHERWISE NOTED.
2. DC RESISTANCE OF TRANSFORMER WINDINGS LESS THAN ONE OHM IS NOT SHOWN.
3. EXTERNAL CIRCUITS TO WHICH MODULE IS CONNECTED IN NORMAL OPERATION ARE SHOWN BY DASH LINES.
4. DC VOLTAGES AT TRANSISTOR TERMINALS WERE MEASURED TO PIN 4 WITH A VTVM HAVING AN INPUT RESISTANCE OF 11 MEGOHMS. INPUT SIGNAL WAS 1.0 MC AT -16.0 DBM. VOLTAGES ARE NEGATIVE WITH RESPECT TO PIN 4 (GRD).

	E	B	C
Q1	17.2	17.6	29.6
Q2	33.8	34.1	38.5
Q3	16.5	15.9	0.1
Q4	38.0	37.7	37.9

5. HEADER POSITION DIAGRAM.

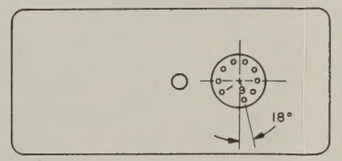
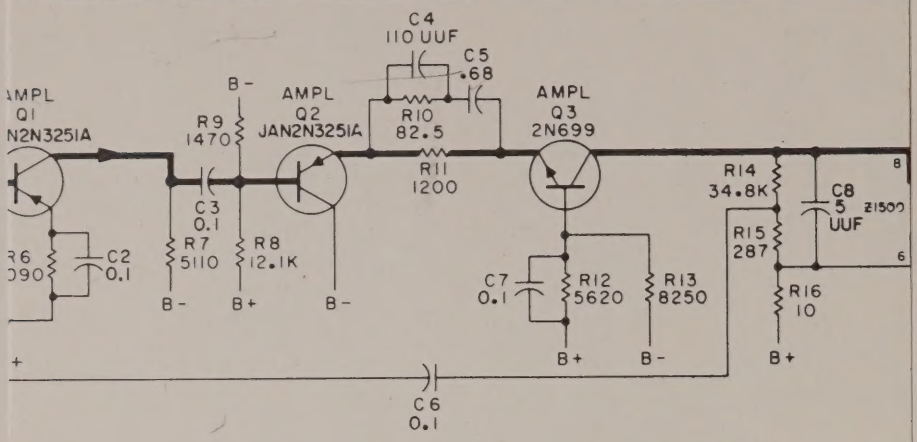


Figure FO-1. Amplifier Schematic Diagram



ICROFARADS

IS LESS

CONNECTED
H LINES.

WERE MEASURED
RESISTANCE OF
AT -16.0 DBM.
O PIN 4 (GRD).